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# Car-Sharing Services – Part B Business and Service Models

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**Abstract.** Among the alternatives for building more sustainable transportation systems, car-sharing systems are becoming popular all over the world also because of the increased number of companies operating in the main cities. Despite the emerging importance of this type of mobility and the large number of papers published in the past two decades, from the analysis reported in the part A of this paper it emerges a clear gap in the car-sharing services literature: an absence of studies linking the business models of the companies operating the service, their business development and the operational models. While such a lack can be partially tolerated in a pioneering phase, it must be compulsorily considered in a more mature phase of the market. In this paper we complete the analysis of the car-sharing sector by means of a deep analysis of business models of a set of car-sharing companies operating in Italy and Europe. The analysis, the first one in the literature considering explicitly the business model and development issues, is performed by means of GUEST, a Lean Business methodology. In more detail, the results are twofold. First, we provide a solid and reproducible methodology to compare the behavior of car-sharing companies starting from the value proposition and the business model up to the definition and validation of the tariffs to use in order to increase the market penetration. Second, we provide a Monte Carlo simulation tool able to simulate the effects of one or more tariff options when applied to a specific customer segment and incorporating real traffic data of a specific urban area.

**Keywords**: Car-sharing, business models, GUEST, lean business.

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# 1 Introduction

The growing urbanization and the increase in greenhouse gas emissions (GHG) have created new challenges for the efficient planning and administration of urban environments. In particular, the planning of an efficient transport system plays a very important role in urbanized societies, because of its social and economic importance in guaranteeing the accessibility of people to their jobs, education, and health services, enabling the supply of goods and services and allowing people to interact. On the other hand, transportation activities are also a source of externalities, due to the environmental impacts they might generate.

According to the International Panel of Climate Change (IPCC), the transport sector was responsible for 11% of the increase in total annual anthropogenic GHG emissions between 2000 and 2010, estimated in 10Gt of carbon-dioxide equivalents. Moreover, 14% of world GHG emissions were released by the transport business which is the sector with the fastest growth in GHG emissions, both in developing and developed countries. Considering only urban areas, approximately 80% of global GHG emissions are originated in cities, with a significant share corresponding to transport activities [2, 12]. Approximately 54% of the population lives in urban areas, and the urbanization trend is expected to continue: estimates are that, by 2045, the number of urban residents in cities will increase by 1.5 times, reaching 6 billion of people. The speed and scale of urbanization add complexity to the challenges for cities to develop well-connected transport systems [2]. The prevalence of private vehicle utilization for mobility purposes in cities with low-density development configures a largely irreversible pattern, which must be avoided in future urbanization and reversed in many existing cities that suffer from the consequences of this development model. In 2014, there were 1 billion passenger cars worldwide, and this number is projected to increase to 2.8 billion by 2050 (although this figure might be mitigated by city management policies). The consequences of predominant use of individual vehicles in car-centric cities are well known: congestion, noise, higher energy use, shortage in parking, inefficient land use, pollution, waste and climate changes [12].

Although policymakers struggle to find solutions and the experts disagree on the definition of policies, many initiatives have been taken in the search for more sustainable transportation systems, less dependent on private vehicles [5, 14]. Aside from investments in public transportation systems (subway networks, public buses etc.), policymakers in urban areas in Europe and other regions have been taking measures to restrict private vehicle utilization and reduce their environmental impact. Examples are strict limits on emission rates, consumption and safety regulations, restrictions in traffic and in access to specific areas of the city, congestion charges and road tolls [18]. These restrictions are tightening in other areas, such as the registration of new vehicles in some cities in China. As a result,

there has been an increasing demand for alternative mobility services.

Among the alternatives, car-sharing is an innovative mobility option that arises as one of the answers for mobility improvement and reduction in private car utilization. Since the first shared used vehicles system can be traced back to 1948 in the city of Zurich (Switzerland), motivated by economic reasons, in the following years other attempt of public car-sharing systems were not successful, and only in the late 1980s the development in the market of communication technology allows the launch of several successful car-sharing programs (such as Mobility car-sharing in Switzerland and Stattauto in Germany). Car-sharing has become worldwide popular in the early 1990s and nowadays can rely on several consolidated projects in more than 600 cities in more than 18 countries [23]. A recent Europe-wide project funded by the European Union even concludes that one car-sharing vehicle can replace up to 8 conventional cars [16].

Car-sharing systems are increasingly popular all over the world, and the number of available shared vehicles also increases because new vehicles are added to the fleets of existing operators and new operators start their activities. Especially in the European market car manufacturers (such as Daimler, BMW and FCA group) are directly involved in car-sharing operations, searching new ways to market the produced cars. As car-sharing emerges as a mainstream mobility alternative, the competition among different players is increasing and is also increasing the motivation for the pursuit of further development of services and sources of differentiation between new competitors.

Despite the emerging importance of this type of mobility and the large number of papers published in the past two decades, it emerges a clear gap in the car-sharing services literature: an absence of studies linking the business models of the companies operating the service, their business development and the operational models [10].

To our knowledge, Beutel et al. are the sole authors that partially analyze the business of sharing mobility services [4]. In details, they mainly focus on car-pooling, using a framework linking business factors and service strategies. The framework considers service aspects, partially considering additional aspects, as the business model, its link to the business development model, as well as the value proposition of the different car-sharing companies. While such a lack can be partially tolerated in a pioneering phase, it must be compulsorily considered in a more mature phase of the market [17].

Aim of our research is to fulfill this gap, providing the first analysis of business models of car-sharing companies, applying it to a set of companies operating in Italy and comparing them with an European company leader. Thus, the first contribution of this paper is to provide a solid and reproducible methodology to compare the behavior of car-sharing companies starting from the value proposition

and the business model up to the definition and validation of the tariffs to use in order to increase the market penetration. Five different car-sharing companies were selected for this analysis: Car2Go [6, 11], Enjoy [9], Car City Club (IoGuido) [15], Autolib [1, 13] and Bee [3]. The choice was done in order to cope with a large set of possible actors, including two large sized companies sharing the same catchment area, Italy (Car2Go and Enjoy), a traditional station based company (IoGuido), a company leader in another country (AutoLib) and, finally, a company who uses a fleet of green vehicles (Bee). A comparative analysis of the companies is conducted, highlighting the main aspects of the companies' business models and the different solutions used to create value and competitive advantages through service differentiation.

The second contribution to the literature is related to the tariffs and the customers segments that should be interested. In fact, car-sharing services are moving from a single tariff based on time or distance to more complicated mix of offers, as happened in the Telco market about 10 years ago. The big difference, in the car-sharing market, is the availability of a consolidated database of data about the user preferences. Thus, we develop an evaluation tool of the economics of car-sharing utilization by introducing a Monte Carlo-based simulator. This tool simulates the existing price and tariff policies or the introduction of new ones of car-sharing companies for different profiles of car-sharing users, according to different mobility needs and traffic congestion of the urban area.

The paper is organized as follows. Section 2 recalls GUEST, the Lean Business methodology applied in the study. Then, the five phases of the GUEST methodology are applied in sections 3-7. In more detail, Section 3 introduces the data sources, Section 4 presents the selected car-sharing operators and their business models, that are compared in Section 5. Finally, according to the results of the analysis of the business models of the car-sharing companies, the simulation environment of tariffs and user costs is presented in Section 6, while the resulting comparison of cost structures of the utilization of services of analyzed car-sharing operators is discussed in Section 7. Finally, conclusions are reported in Section 8.

## 2 Methodology and theoretical basis

Although there are already extensive studies concerning the potential impacts of car-sharing, the user behavior and potential demands and also case studies of operating companies, few studies have been conducted through a comparison of different car-sharing companies. More specifically, there is a lack in the analysis of the coexistence of different car-sharing companies in the same environment and how they can operate in a competing scenario (a situation that becomes more common given the car-sharing market growth and the entrance of new players in

the market). The definition of the methodology is crucial. On one hand, the relative novelty of the car-sharing services pushes to consider the methods developed in the literature for startups [17, 22]. On the other hand, the methodology should be adaptable to existing companies and repeatable. In fact, even if Riess writes, "start-uppers are everywhere", considering an existing company as a startup might introduce distortions in the analysis. For these reasons, we adopt the GUEST methodology, developed in the past years by Perboli and Gentile [19]. GUEST is a lean business methodology extending the work done by Osterwalder [17] and all the Lean Startup movement, adapting their results to the environment of already existing companies and to products or services of companies which are actors of a Multi-Actor Complex System (MACS). GUEST is the acronym of the 5 consecutive steps of the methodology itself: Go, Uniform, Evaluate, Solve and Test. GUEST controls the process from the idea to the implementation and provides a conceptual and practical tool to the different stakeholders and actors to connect in a common framework their visions, issues, problems and opportunities. Each step of the methodology guides the actors in the control of their projects, while giving a standardization of the documents and the tools used to evaluate their ideas, goals, actions and results. The tools and the documents are taken from the literature and are thought to simplify the inclusion in the project development of people with different backgrounds. The standardization of the tools and the documents provided at the end of each step gives a way to build a common knowledge base of the MACS under study, making easier to compare different solutions.

The five steps have the following meaning:

- Go: a full description of the company profile, its present behavior and business development status, its environment, the external actors in the system and their interactions;
- Uniform: the knowledge of the system must be assessed in a standard way, in order to obtain a shared vision of the MACS. In particular, in this phase the governance and the business models are explicitly described by means of the Business Model Canvas [17];
- Evaluate: the governance and the business models are assessed in a series of actions. The full structure of the costs and of the revenues is explicitly described in order to evaluate the goals of the initiative. Moreover, a series of problems and opportunities are identified, as well as the actions able to manage them and the KPI to measure the effectiveness of the actions;
- Solve: given the specific problems and the actions highlighted to cope with them, a list of operational models are proposed;

- Test: the actions are actually implemented in case studies and their performance are evaluated. Moreover, the findings of the actions are disseminated according to the Results Dissemination Plan.

Regarding the present application of GUEST to car-sharing services, the five steps were declined as follows:

- Go: the data of the car-sharing companies are gathered by means of primary data;
- Uniform: for each company, a Business Model Canvas (BMC) is derived [17];
- Evaluate: a deep analysis and comparison of the BMCs is performed, bringing out as the main key linking factor between the business and the operational models of car-sharing companies the tariffs evaluation. So, it is a priority to have a tool able to evaluate the impact of tariffs on different types of customers;
- Solve: a Monte Carlo method is developed to obtain, for a given customer type, the real cost paid by users under real urban areas congestion rates;
- Test: the Monte Carlo method is then tested on three typical customer types (Commuters, Professional users, Casual users) in the urban area of a medium-sized city, Turin.

# 3 Go - System analysis and data gather

In this phase, the primary data needed to make the study were gathered. The information about the companies included in the analysis, regarding their creations, strategies and business aspects were gathered in a variety of sources. The main sources were financial statements and other public data made available by companies listed in stock markets, the company web sites and the official data given by the companies themselves. If needed, a mystery client visit was performed in one of the company shops. Other sources were scientific publications focused on the companies included in this study (when available), public contracts in case of publicly owned companies and regulation contracts for the operation of private companies.

# 4 Uniform - Business Model Canvas

The aim of the analysis of the company's business models is to identify the resulting differences and similarities between different service modes, including round trip

car-sharing, point-to-point station based car-sharing and free-floating car-sharing. The pool of companies includes different private sector and public operators in order to understand eventual differences in the business models of both sectors. Furthermore, another objective was the understanding of the implications of electric vehicles in the business model, in fact two companies operating only with electric vehicles were included in the comparison, Autolib and Bee. Consequently, five different companies are included in the analysis, resulting in a varied pool that should allow a better understanding of the influence of many different factors in the car-sharing companies business models and operations: Car2Go, Enjoy, Car City Club, Autolib and Bee.

A description of the selected car-sharing companies is conducted based on the identification of their main business aspects, which are represented with the utilization of the Business Model Canvas (BMC). The BMC, a strategic management and entrepreneurial tool [17], illustrates in a visual way the business model of a company or organization, which, according to Osterwalder, describes the rationale of how an organization creates, delivers and captures its value. Therefore, this managerial tool is designed to contain the main useful information to develop new business ideas and innovative Start-Ups, or to remold existing organizations. Given its user-friendly display of information in a graphical template, it allows an easier understanding of a company, the creation of alternative scenarios and the evaluation of possible trade-offs between the elements that compose the system.

For these reasons, the construction of the BMC for each company studied was considered a pertinent methodology to endorse a comparative analysis. The key factor determining the success of the canvas can be explained by the immediate display of the main information needed to determine the areas in which the managerial team should concentrate its efforts. Moreover, the relationships between the elements of the organization and the way they should be logically linked are presented in an efficient way.

The Business Model Canvas consists in nine different building blocks, which are defined as follows.

- Customer segments: the customer segments building block defines the different segments (of people and/or organizations) a company aims to reach and serve. It is necessary to carefully understand the demand for each customer segment, which is defined on the basis of its common characteristics, behaviors and requirements.

- Value proposition: the value proposition of a company is the combination of products and services the company offers to satisfy its customer segments' needs. Basically, it determines why customers choose one operator according to the value the company creates to clients with the mix of services and

products delivered. The values might be quantitative (e.g. price, volume, speed of service) or qualitative (e.g. design, customer experience).

- Channels: the channels building block describes how a company reaches and communicates with its customer segments to deliver a value proposition. The communication, distribution and sales channels comprise the company interface with its clients, playing a very important role in the customer experience. A company should evaluate how the different customer segments want to be reached, how the channels are integrated, which channels work best, are more cost-efficient and how the channels are integrated with the customer routines.

- Customer relationships: the customer relationships building block describes the types of relationships a company establishes with specific customer segments. This block comprises how the company acquires new clients, retain clients and boost sales through the relationships with clients or potential clients.

- Key resources: the key resources building block enumerates the most important assets required to make the company's business. In other words, the key resources are the assets needed to guarantee the company operations, the relationship with the customers, the creation and offer of a value proposition and the revenues.

- Revenue streams: the revenue streams building block represents the revenues the company generates from the commercialization of its products and services to each of its customer segments. Through the understanding of the needs and the willingness to pay of each customer segment, a company can generate or increase its revenues.

- Key activities: the key activities building block describes the strategic activities a company should perform to make its business model work, operating successfully. In other words, this block displays the most important actions a company must take on a regular basis in order to offer a value proposition, reach markets, maintain customer relationships and earn revenues. Similarly to key resources, the key activities vary according to the company's business model.

- Key partnerships: the key partnerships building block determines the network of partners and suppliers necessary to make the business model operate correctly. Through the creation of partnerships, companies can optimize the allocation of resources and achieve scale economies, reduce risk and uncertainty in the competitive environment, acquire particular resources and

activities, compete in broader markets, promote their brands and reach new clients.

- Cost structure: the cost structure building block defines the main costs incurred to operate a business model. When determining the cost structure, it is vital to consider the key resources, partnerships and activities to determine if there are opportunities of cost reductions or if the costs are already optimized according to the desired results.

## 4.1 Car2Go

Car2Go, a subsidiary of Daimler AG, was founded in 2008 in the city of Ulm, in Germany, and currently offers car-sharing services across 30 cities in 8 different countries in Europe and North America, serving over one million customers with about 13000 vehicles. The company is one of the biggest players on the car-sharing market worldwide, and over the years it has built a strong brand recognition, benefiting from its pioneer position in the market (since it was the first company operating a free-floating car-sharing service) and also from the scale of its operations.

A key element of Car2Go strategy is operating in large scales in the cities, covering the most important central areas in terms of demand for transportation and travel fluxes and with an elevated number of vehicles in the fleet. As a result, the company aims to meet the customer demands with high availability of vehicles, generating greater revenues and guaranteeing higher customer satisfaction. The characteristics of the vehicle fleet also play a key role on brand recognition: the fleet is completely composed of Smart ForTwo vehicles, produced by Smart Automobile, a division of Daimler AG. All the vehicles are painted in white and blue with company name, logo and slogans to create a strong visual identity that allows the vehicle to serve as a marketing channel, increasing brand recognition. The fleet combines gasoline and electric powered Smart ForTwo models; the recent introduction of electric cars in selected cities (Austin, Vancouver, San Diego, Amsterdam, Portland and Stuttgart) is an additional source of value creation to the company customers, creating an environmental awareness.

The business model is the same in every location the company operates, offering free-floating rentals. After the utilization, the customer can park the car in any specially designated parking spot or in standard parking areas with a special permit from the local municipality, instead of being obligated to return it to the same place where the rental started. The company charges a subscription fee upon the registration of new customers, and the service is charged in a per-minute basis (the rates include rental, fuel consumption, mileage, insurance, parking in authorized areas and maintenance). Discounted hourly and daily rates are also available and

an extra fee per kilometer applies when the included mileage, which is usually 50 kilometers, is exceeded. Subscription fees and rental fees are the two main revenue streams for the company.

Customers can locate and reserve a vehicle through Car2Go website, by means of a smartphone application or directly on the street, where the car is parked; the website and the application serve also as marketing and communication channels. Car2Go has mainly focused its marketing efforts in the segment of young adults, which corresponds to a relevant percentage of users (young adults are more likely to respond to innovative initiatives, usually have higher awareness of environmental causes and are also more likely to face higher budget constraints, thus searching more for alternative and economical mobility alternatives). Moreover also corporate clients are an interesting customer segment for the company.

Car2Go value proposition is based on delivering an innovative and environmental friendly transportation service, offering flexible urban mobility. The service has been designed in order to complement available transportation alternatives, meeting customer demands that are not satisfied with public transportation services or with the use of private vehicles; the value proposition is disclosed through the website and the mobile application. Other channels to reach the population and conquer new clients are marketing campaigns launched in areas of high circulation of people in the cities, for instance through the installation of information points in the city center for the penetration of the service, especially when the company is starting its operations in a new site. Customer relationships are automated, and the customer interface consists of the website and the application, which are developed to provide all the necessary means for customers to help themselves in a self-service basis.

The key resources required to make the business model work are the vehicle fleet, the designated parking spots, the service team, responsible for the relationship with customers and for the maintenance and supervision of the business, the website and smartphone application and an integrated information system through which the company manages the service, including ICT devices installed in every vehicle. The main key activity of the company, which represents its core business, is the car rental. Other key activities must be performed to keep the business running properly: the maintenance of the vehicles (including cleaning and fueling), the management of the fleet (vehicle repositioning, checking if cars were delivered in appropriate spots etc.) and the customer service (assisting customers in case of need).

The company aims to minimize its costs with fleet management: instead of actively repositioning the fleet, the operation is projected so that the fleet can be managed more passively, with the customers being responsible for the majority of changes in vehicle positions. However, the company still has to monitor the place-

ment of the fleet and eventually intervene moving vehicles according to demand unbalances. In order to leverage its operations, the company seeks to establish partnerships with local governments, which can collaborate giving in public spaces for designated parking areas or work on agreements for the use of standard parking spots by the company customers and the free circulation in limited traffic areas. A key partnership has been established with Europcar, an international car hire company. Car2Go benefits from the extensive knowledge of the car rental company on the areas of fleet management and logistics; both companies also benefit from cross-selling and cross-marketing practices, referring to their partner services in their customer channels and offering advantages (usually discounts) for customers of both services. In order to save personnel costs and maintain the cars in usage conditions, the company also establishes a partnership with its own clients, stimulating them to refuel the vehicles in exchange for free minutes of the service.

The main costs the company incurs are those related to the key resources and activities: acquisition of the vehicle feet, maintaining, fueling and cleaning the vehicles, personnel costs and customer services, system operation and maintenance, insurance contracts, other expenses related to eventual improper use of the service and fees related to the usage of parking lots and access to limited traffic areas.

The business model is illustrated in Figure 1.

## 4.2 Enjoy

Enjoy, a car-sharing company created by ENI, an Italian oil and gas company, started operating in Milan in the end of 2013 with great success: besides Milan, it is already present in Rome, in Florence and in the first semester of 2015 launched its services in Turin. Enjoy business model is based on free-floating car rentals. Customers can register themselves for free in the company website and the service becomes immediately available; vehicles can be located and reserved through the website or a smartphone application, or optionally directly on the streets.

The main customer segments Enjoy serves are, similarly to the other car-sharing companies, private users and corporate clients. Enjoy charges a fee per minute of utilization, which already includes costs with fuel, parking, maintenance and insurance, and offers a reduced fee during the period a driver chooses to park the car without ending the rental; hourly and daily discounted fees are also available. In agreement with local authorities, Enjoy vehicles are allowed to circulate in limited traffic zones in the city centers and can be parked in regular paid public parking spots; the municipalities, on the other hand, usually fix a maximum limit for the number of vehicles operating on the fleet and charge an annual fee per active vehicle.

Together with ENI, Enjoy main partners are Trenitalia, the main Italian train operator company (the companies have agreements for the integration of services

and mutual collaboration), FCA (Fiat Chrysler Automobiles), an Italian car manufacturer (supplier of the Fiat 500 fleet, painted in red and carrying the company logo on the doors), and CartaSi, a credit card company with which Enjoy has specific agreements for the payment system and services. The partnership with Trenitalia is strategic for Enjoy in its focus on corporate clients, which represent an important customer segment. Both companies benefit from cross-marketing, as each company announces the partner services in their customer channels. Besides, through cross-selling practices the partners increase their revenues and reach a wider customer base. The company has also established partnerships with other supplier companies, e.g. a company specialized in vehicle cleaning, a uniform supplier for the service team etc. Other important partnerships must be negotiated with the local municipalities for the regulation of the service and the guarantee of circulation and parking permits for service users in standard public parking spots inside the area covered by the service.

Similarly to other car-sharing companies, other value propositions are the accessibility, flexibility, practicality and environmental friendly characteristics of the service. Another source of value is the integration with the premium train services in Italy. Through Enjoy website, customers can make their registrations and create their account, find information about the service and also locate and reserve vehicles. The company has also developed a smartphone application through which customers can locate vehicles and access information about them (such as location and fuel level), make reservations and also open the car, without the need of a card or a key; moreover, a 24 hour dedicated call center can assist customers without extra charges.

Customer relationships are automated, and the customer interface consists mainly of the website and the mobile application, which are developed to provide all the necessary means for customers to help themselves on a self-service basis; a 24 hour operating call center is also available for customer assistance. Enjoy does not charge registration or fixed annual fees to its clients. Therefore, rental fees are the main revenue stream: the company charges an all-inclusive per minute fee, and also offers the clients the possibility to park the car without ending the rental period, in which case a discounted per minute fee applies until the customer starts the engine again or decides to end the rental. Discounted hourly and daily fees are also available, including 50 kilometers of mileage, after which an extra fee per kilometer is charged. Enjoy key resources are the vehicle fleet, the service team responsible for the maintenance of the cars and client services, an integrated information system, that contains all the information related to customer base, payments, vehicle fleet etc., and is a key tool to the management of the company, the website and the smartphone application, which are the main channels for the customers to reach the service.

Similarly to other car-sharing companies, Enjoy main activity, which represents its core business, is the car rental (and since July 2015 also scooter rental in some cities). A set of activities must be performed to keep the business running properly: the development and maintenance of the app and the website, the maintenance of the vehicles (including cleaning and fueling), the management of the fleet, and the customer service (assisting customers in case of need). Other important activities are related to marketing campaigns and efforts to establish new partnerships, which are drivers for the success of the company expansion in new markets.

The main costs the company incurs are those related to the key resources and activities. Among the costs, those with higher relevance are: the acquisition of the vehicle feet, maintaining, fueling and cleaning the vehicles, personnel costs and customer services, system development, operation and maintenance, insurance contracts, other expenses related to eventual improper use of the service.

Enjoy also incurs in paying municipalities annual fees in order to be allowed to operate and benefit from specific terms agreed with local municipalities, for example the possibility of parking the cars in any standard paid parking spot and circulating in limited traffic zones.

The business model is illustrated in Figure 2.

## 4.3 Car city club (IoGuido)

Car City Club is a car-sharing company run by the city municipalities; it is an associate member of the car-sharing initiative (ICS), a national coordination structure promoted and sustained by the Italian Ministry of the Environment. The aim of the ICS is to offer support to local municipalities interested in developing local car-sharing services, stimulating the creation of a national car-sharing network and promoting sustainable mobility policies. ICS offers financial, technical and legal support to the associated local companies, besides assisting the design of car-sharing systems and services. In the course of operations, it also assists the companies during the startup of the program, communication, promotion and marketing services, technology and know-how for the fleet and service management and call-center services. The associated companies must comply with homogeneous standards regarding services, emissions and safety, in order to guarantee a minimum quality, the interoperability among the participant cities and common services and user procedures. Given the standards and the know-how supported by the ICS, the associated companies business model is the same, with similar operational procedures.

Car City Club offers two different rental possibilities: the classic modality, in which customers must deliver the car in the same parking area where they started the rental, and the one-way rental, in which the customer can deliver the car in a parking area different to that in which he started his journey. In both cases,

customers must make a previous reservation, indicating the vehicle they want to rent and the initial location (according to availability), the renting period and the location where they want to deliver the car at the end of the rental. The company charges a fee per kilometer in addition to an hourly fixed fee: prices vary according to the vehicle chosen, the rental conditions (classic or one-way rental) and the period of the day, and the fee per kilometer also decreases with the increase in the distance traveled; daily rentals are also possible.

IoGuido main customer segments are both private users and corporate clients, who complement or substitute their fleet for the shared vehicles; among the clients there are also public entities, e.g. the city municipality. The company value propositions are based on the creation of a mobility alternative, complementing the other existing public transportation systems with a low environmental impact, offering its users the possibility of utilizing a private vehicle without the necessity of owning one. Customers recognize value in the wide variety of vehicles in the company fleet, which allow them to choose a model according to different needs (in the last years the fleet has increased also with the inclusion of electric vehicles).

The main channels to reach customers are the company website, a smartphone application and a call center. In the website, the company provides a detailed explanation of its services and offers the possibility for new customers to register their profile and change their account conditions. The clients can make car reservations through the website, the mobile application or the 24 hour available call-center. Customer relationships are therefore automated, and the customer interface consists of the website and the application, which are developed to provide all the necessary means for customers to help themselves in a self-service basis.

IoGuido revenues consist of the annual fee charged from its customer base to keep their profiles active and the rental fees. Annual fees vary according to user characteristics (private or corporate clients) and to the service options. Users can choose to pay an annual fee to have full access to the service during the year, or alternatively they can pay a smaller fixed activation fee every time they use the service (in addition to hourly and per kilometer fees). The key company resources required to make the business model work are the vehicle fleet, the exclusive parking spots, the service team (which is partially shared with ICS) responsible for the relationship with customers and for the maintenance and supervision of the business, and the website and smartphone application. Beside the car rental, other key activities must be performed to keep the business running properly: the maintenance of the vehicles (including cleaning and fueling), the management of the fleet (vehicle repositioning, checking if cars were delivered in appropriate spots etc.) and the customer service.

Car City Club main partnership is established with ICS (for technical, legal and financial support), in association with the Italian Ministry of the Environment.

Being a public service company run by the city municipality, Car City Club benefits of distinct advantages, namely the gratuity for customers to park in the streets while the service is active, the designated parking spots in public areas and the right for its cars to circulate in restricted traffic areas, as well as tax related benefits. The company also seeks to establish further partnerships with other companies (e.g. retail stores, shopping malls, universities) thus offering exclusive parking spots in their parking areas and/or other combined agreements and promotions in order to reach new clients. IoGuido has also established other partnerships or agreements with strategic suppliers, for example car manufacturers (the vehicle fleet is composed exclusively by FCA group cars), fuel distributors and insurance companies.

The main costs the company incurs are those related to the key resources and activities, namely: acquisition of the vehicle fleet, maintaining, fueling and cleaning the vehicles, personnel costs and customer services, system operation, insurance contracts, other expenses related to eventual improper use of the service. Some of the costs are subsidized by the Italian Ministry of the Environment, in the scope of stimulating local municipalities to develop car-sharing companies in association with the ICS organization, in order to improve urban mobility with integrated, more effective and environmental friendly services.

The business model is illustrated in Figure 3.

## 4.4 Autolib

Autolib is an electric car-sharing company operated by the Bollore' industrial group, in association with Paris Municipality. As a part of a Parisian plan of remodeling its public transportation system, in order to reduce traffic congestions, atmospheric and noise pollution, and following the launch of Velib (a successful bike-sharing service) in 2007, the City of Paris issued a call for proposals of an electric car-sharing mobility service to be developed in the city. The successful proposal was Autolib, presented by the French investment and industrial holding group Bollore', which did not have experience in transportation services or in the car manufacturing industry, but had been involved in research and development of new battery technologies.

Autolib service is based on full electric powered Bluecars, a model developed by Bollore' group in association with Pininfarina, the independent Italian car designer firm and coachbuilder, and produced by CECOMP, an Italian car manufacturing company. The company offers one way point-to-point station-based rentals, and currently operates with more than 2500 vehicles and 875 parking stations, with over 4000 charging points (it was the first extensive public electric car-sharing system ever created). The large scale of its operations is an essential element for the company strategy and service proposal, which is to offer a practical, low en-

vironmental impact mobility alternative, complementary to other available public transportation services. In the end of 2013, Autolib expanded its operations in France, offering its services in Lyon, and at the beginning of 2014 it also started operating in Bordeaux. Bollore' group has also signed deals to start operating experimental offshoots of Autolib in Indianapolis (USA) and London (UK) in 2015.

The main segment of this service is composed by private users, but multiple drivers and corporate plans are also available: this way, the company aims to meet the demand of different segments of customers, comprising frequent users, occasional users, tourists and corporations, offering annual, monthly, weekly and daily service plans. By offering a variety of service plans, the company reaches customers with different needs and characteristics. In addition, Autolib also offers the service of charging stations for private electric cars, motorcycles and bikes owners, which was a requirement imposed by the City of Paris during the company creation.

Autolib is characterized by a self-service platform, in which customers can access the service by themselves in any Autolib station available. Therefore, the primary channels for the delivery of the service are the stations. Besides, the company has a Reception Center with staff dedicated to the advertising of Autolib and to the customer service, solving users problems and helping them through the necessary process regarding the subscriptions. The main channels accessed by customers, however, are the website and the smartphone application; through these channels customers can get all the information concerning the company (services, fares, etc.), find the closest Autolib station, check for available cars, parking or charging slots and make reservations. In addition, Autolib also offers a 24h operating call-center, which can be contacted directly through the car, or optionally by telephone, in case customers need further assistance. The website and the mobile application are also the main customer interfaces for the company. However, the company has a customer service team to assist users in case of need. The staff can be found on site at the Autolib kiosks or Reception Center, or optionally can be contacted through the call-center. If necessary, the company will send a staff member to assist the clients.

Autolib revenue streams are generated by the three different lines of services it offers: private user car-sharing plans, corporate clients car-sharing plans and charging station service plans. In all three service types, the company charges a subscription fee (valid for a defined period of time, renewable) and a fare per utilization. Private users have access to a varied range of service plans, from daily to annual subscriptions; rentals are charged per minute, and the fares per use decrease with the increase of the service plan duration. Corporate clients can also opt for a varied range of service plans, which include a number of subscribers and hours of rental in the package.

Essential resources for Autolib are the vehicle fleet and the stations with parking spots and charging facilities; in addition, the company relies on its website and smartphone application as the main customer interfaces, which are fundamental to deliver the service properly. In order to manage operations, another key resource is an integrated information system, containing all the necessary information regarding revenue streams, customer profiles, reservations, car availability and positioning, which are fundamental inputs for the correct operation of the service by the management team. Other resources are the Reception Center and Autolib kiosks, through which the company reaches its customers and register new users, and the service team.

The key activities for Autolib are the maintenance of vehicles, the management of the fleet and the recharging of vehicles. However, the company still has to manage the fleet and eventually reposition vehicles that might have been left in inappropriate places or that might be overly concentrated in some areas of the city, although this particular situation is more common in free-floating car-sharing services. Another important activity is the customer service: the service team must assist the users in any case of need and be available 24 hours a day. The development and maintenance of information systems is also quite important for the managerial activities in the company. Besides, the development and maintenance of the website and the smartphone application are fundamental for the service performance, as these two platforms are the main customer interfaces. In addition, marketing efforts, client surveys and interaction with customers are important to understand customer demands and reach a larger client base and better levels of service.

Autolib is run by a public-private joint venture between the City of Paris and the Bollore' Group, which might be considered Autolib main partners. The company has also established agreements with other partners during its development and implementation phases, among which the most important are Bluecar (responsible for the development and commercialization of the electric vehicles), Pininfarina (coachbuilder and car designer company), batScap (a research center dedicated to the development of the batteries), CECOMP (the vehicle producer) and other French municipalities.

Autolib cost structure is directly related to the key resources and key activities on which the company depends to perform its services. Hence, it is possible to list the main costs as follows: Bluecar fleet acquisition, maintenance and cleaning, installation of Autolib stations, information kiosks and reception center, managerial activities, including strategic and operations management, customer services and personnel costs, development and maintenance of integrated information system, website and smartphone application, insurance costs, other costs related to improper use of the service.

The business model is illustrated in Figure 4.

## 4.5 Bee - Green mobility sharing

Bee is a car-sharing service created by NHP ESCo, a company that operates in the green economy sector, designing and manufacturing equipment that generates energy from renewable sources and realizing interventions for energy efficiency improvement. Bee started operating in 2013 in the city of Naples, in Italy, as the first electric car-sharing company in Italy. The usage of electric vehicles is a key to the company strategy of offering a low environmental impact mobility alternative, in line with its creator company business philosophy. Bee operates with a fleet of Renault Twizy vehicles, a compact model, powered by an electric motor, with a range of 80 km per battery charge and capacity for two people. Until 2014, the company operated with a point-to-point station-based service mode. Customers could reserve the vehicles or directly find them in one of the 30 available Bee-Points, proprietary parking areas equipped with charging plugs spread in strategic areas in the city. In the point-to-point station-based service mode, upon the reservation, it was mandatory for customers to decide beforehand for how long they would use the car or where they would deliver it. When ending the rental, however, customers could only return the car in one of the Bee-Points. The company had established an agreement with Naples municipality in order to permit the use of the cars in restricted traffic areas in the city center, in preferential lanes and also for the right of parking the car for free in standard parking spots in the streets, if users needed to park the car before ending the rental period. Since October 2014, Bee has started to operate with the free-floating mode: in this new operation strategy, customers can start and end their rentals in standard parking spots on the streets inside the free floating area, without the obligation of parking in the Bee-Points (which have been reduced to 11 in 2015). The company is responsible for managing the fleet and charging the vehicles, but customers that rent the car for longer periods can recharge it anywhere, or alternatively in the available Bee-Points (for free).

Bee charges an activation fee, offering different options to its clients, and rentals are charged per minute and include maintenance, insurance, battery charge and parking. The main customer segments Bee serves are, similarly to other car-sharing companies, private users and corporate clients: Bee offers different service plans for both segments, trying to suit customer needs. It also offers its customers the possibility of suggesting new tariffs and service plans on the website, in case they feel their necessities are not met. The company then analyses the proposals, which can turn into a new service plan offered by the company.

Bee centers its value propositions in offering a low environmental impact mobility alternative, operating with a free float model and a fleet of electric vehicles. Customers recognize value in the environmental friendly philosophy of the com-

pany, but are also driven by the flexibility of the service, which provides them other benefits. Some of these benefits include the possibility of driving inside the limited traffic zones in the city center, parking with no extra costs in the standard parking areas on the streets and also the possibility of parking at the Bee-Points, which is a great advantage considering the eventual difficulty of finding parking spots in the city. Bee vehicles are also allowed to circulate during periods in which all the other cars face traffic restrictions, when the city reaches high concentration of atmospheric pollutants.

The main channels the company holds are the website, the call center (free of charge and operating 24h a day) and the smartphone application. Through the channels, customers can locate a vehicle in a map, also having access to information about the battery charge, and then make a reservation. The registration of new customers is made in the website, where the company also keeps a space for customers to suggest new service plans and contact the company for any purposes (solving doubts, giving feedback, etc.). Similarly to other car-sharing companies, customer relationships are performed through the automated customer channels, which are developed in order to guarantee customers the possibility of using the services without further assistance. Optionally, clients can also reach the company through the customer service call-center.

Bee has two different revenue streams: subscription fees and rental fees. The company charges annual subscription fees from private users and corporate clients, with different options of service plans, and alternatively a 3-day subscription that might address specific needs of private users, for example tourists visiting the city. Rental fees are charged per minute of utilization; the fees are all-inclusive, and the customers do not face any extra costs with insurance, recharging, maintenance, parking or customer services.

Bee key resources are: the vehicle fleet, the Bee-Points, private parking areas with adapted infrastructure to recharge the vehicles, an integrated information system, used to manage the fleet, process of reservations, management of rentals and revenue streams, the website and the application, which are the main company channels, the service team, responsible for the maintenance and client services.

The main activity Bee performs is renting cars, operating with the free floating model of car-sharing; in order to offer this service, which generates the company revenue streams, Bee has to perform several different activities. The company must keep its resources in good operating conditions, realizing the maintenance of the vehicle fleet (including recharging and cleaning) and of Bee-Points, and also developing and maintaining the website and smartphone application, in addition to offering the customer service to assist clients during the service utilization. Bee has also the need to manage the service and the vehicle fleet. Other important activities are related to the management of the company and the definition of

its business strategy. It becomes imperative to understand customer needs to improve the service constantly, and also to establish partnerships and agreements to maintain or improve the operating conditions.

Bee has established important partnerships to guarantee the feasibility of its business proposition: the company main partners are Renault, Siemens, ALD Automotive and TomTom Telematics. Renault is a key partner, supplying the electric vehicles that compose Bee fleet. Siemens is a global leader in smart grid and charging station technology, playing an important role in the development and installation of the Bee-Points. ALD Automotive, a global player in the full operational leasing and fleet management industry, and TomTom Telematics, global leader in professional service of vehicle tracking and tracing, with a particular point on on-board information, provide the company the know-how and technology necessary to vehicle location and fleet management. Bee has also established local partnerships for the installation of Bee-Points in private areas.

Bee main costs are directly related to its key resources and the activities the company performs. Among the most relevant we identify: the acquisition of the vehicle fleet, the installation and maintenance of Bee-Points, the development and maintenance of integrated information systems, website and smartphone application, the operational costs related to maintenance, cleaning and recharging of the vehicle fleet, as well as its management, customer services and personnel, insurance contracts costs, other costs related to improper use of the service.

The business model is illustrated in Figure 5.

# 5 Evaluate - Comparative analysis of car-sharing companies

The objectives of the comparative analysis are to identify the advantages and limitations of the different strategies adopted by the companies and to analyze the conditions in which the companies might coexist and compete in their shared markets.

To begin with, all five companies share value propositions inherent to the car-sharing concept. Offering a mobility alternative with low environmental impact, complementary to the available public and private transportation modes and economically efficient when compared to car ownership is a value proposed by all of the analyzed companies. However, the degree in which the companies succeed in delivering these values to their customers depends on their operations characteristics.

One of the main sources of differentiation for car-sharing operators is the service model adopted, which is also evaluated in the value proposition of the companies.

The option for traditional round trip car-sharing reduces the complexity of fleet management, since the vehicles are returned to the same dedicated parking spaces where they were initially rented. However, this form of operation provides less flexibility for the users, which must start and end their journey in the same parking spot and pay for the service during the entire time of rental. Consequently, this operation model, which is one of the two adopted by the company IoGuido car-sharing, is not the most convenient for the customers' routine needs of transportation between their homes and workplaces, being more suitable for occasional usage. The point-to-point station based service model, on the other hand, grants customers more flexibility when compared to round-trip car-sharing. As a trade-off, the car-sharing operators face more challenging logistic operations, since the positioning of the cars are subject to unbalances resulting from concentrated demands and usage patterns. It is a key-issue for the operators to deal effectively with this problem in order to increase the vehicle usage and the market penetration. The point-to-point free floating service model, offered by Enjoy, Car2Go and experimentally by Bee, is the car-sharing service that provides to the customers the maximum flexibility among the existing operation models. In this service model, customers can locate, optionally reserve and then access an available vehicle directly on the street and use it for the desired time interval. At the end of the rental, the car can be parked in any standard parking spot on the streets inside the city area covered by the service. This form of operation reduces the need for dedicated parking spaces, but carries the highest fleet management complexity. Besides, the elimination of proprietary parking spaces might create difficulties for customers in areas where it is hard to find available standard parking spots. This problem is usually addressed by the free-floating car-sharing companies with the creation of designated parking spots in critical areas as train and metro stations. Point-to-point operation models are those with the highest potential to meet customer demands, complementing the available public or private transportation systems and possibly substituting private cars. However, the fleet availability is an extremely important value that must be delivered by the car-sharing companies if they wish to reach the aforementioned objectives, especially if they aim for substituting car ownership.

Autolib, Enjoy and Car2Go rely on large scale operations with large fleets to address this question, trying to minimize fleet management efforts and letting the spontaneous use of the service by their customers to reposition the largest percentage of vehicles. IoGuido and Bee, on the other hand, recently adjusted their service models and operate in a smaller scale. The characteristics of the vehicles offered in the fleet are also a considerable value for customers: usually, car-sharing companies bet on compact urban vehicles, which are easy to drive and can be parked in limited spaces. The standardization of the fleets provides the

companies a stronger visual identity, increasing brand recognition by customers, and also facilitates fleet acquisition and partnering with vehicle suppliers, besides reducing maintenance costs. IoGuido, on the other hand, offers a choice of different vehicle types, ranging from compact cars to sport utility vehicles and cargo vans, meeting different customer needs. Autolib and Bee have opted for pure electric vehicle fleets, which are imperative for their strategic views. Bee was created by a company operating in the green energy field, while Autolib has among its main objectives the reduction of pollution originated from traffic in the city of Paris. Car2Go also offers fleets comprised of electric vehicles in selected cities (e.g. Amsterdam) and IoGuido recently added to its fleet a few electric units. The option for electric vehicles is motivated by environmental purposes and also by the belief of further value creation for educated customers who are aware of the environmental impact caused by the extensive use of fossil fuels. However, electric vehicle fleets increase the operational complexity, since the electric vehicles have lower range and demand considerably more time for recharging, besides the need for proprietary charging stations.

Building a large customer base and increasing the average service usage among customers is very important for the car-sharing companies. Private companies must reach a minimum target of service hours to break-even and turn the operations into a sustainable business, while public companies must meet the public demands to create the aimed positive impacts on traffic, mobility and environmental spheres. The car-sharing companies focus on three aspects to reach their customer bases, corresponding to three of the business model canvas building blocks: customer channels and marketing efforts, partnerships to target specific customer segments, and definition of service plans and billing strategies (which compose the revenue streams) to meet customer demands. To begin with, all of the considered companies rely on common customer channels, reaching their clients through the advertising of their services on proprietary websites or by the word of mouth and supporting their client base through smartphone applications, call center services for personal assistance and once again through the website, besides the social networking channels. Also, all the companies applied similar marketing strategies for the advertising of their services, realizing marketing campaigns in areas of high circulation of the cities where they operate, mainly during the launch of the services.

The definition of pricing strategies is also important when addressing different customer segments, given the fact that different price structures and models of service are more suitable for different customer needs. Among the five considered companies, only Enjoy does not have specific service plans directly targeted to corporate clients, although corporate clients are one of the customer segments of the company. All the other companies offer plans with multiple subscriptions

and discounted rates to meet the demand of companies that might complement or substitute their private fleet with car-sharing services. All the companies charge the service usage proportionally to the rental period, and the fees already include costs related to refueling or recharging, maintenance, insurance and parking. Car-sharing companies can benefit from strategic partnerships to leverage their operations, complementing their internal capacities and reducing costs.

The five companies have established buyer-supplier partnerships in order to assure a reliable supply of the main assets necessary for their operations. Particularly, the companies Enjoy, IoGuido and Bee have agreements with vehicle suppliers for the acquisition of their fleets, which represent significant fixed costs. Bee fleet has electric vehicles only supplied by the French automaker Renault, while IoGuido and Enjoy have the automotive company FCA as a partner, responsible for the supply of the entire vehicle fleet of both companies. Given the larger scale of operations of Enjoy, it is expected that the company achieves higher scale economies and relative cost reduction on the acquisition of the fleet. Car2Go, on the other hand, is a subsidiary of the Daimler AG group, which produces the Smart ForTwo models used on the fleet. The Bollore' Group, which runs the company Autolib, has developed its own vehicle, the BlueCar, with the collaboration of strategic partners such as Pininfarina, the Italian design studio, and CECOMP, an Italian car manufacturer responsible for the production of the vehicles.

Other important partnerships concern the technology necessary for the operation of the business, including the development of integrated information systems for the fleet management, which must be connected to the devices installed in the vehicles, registration of users, billing process and other internal activities. Car2Go established a partnership with Europcar, a traditional car rental company that provides the necessary know-how for the fleet management. Bee has like partners ALD Automotive, a global player in the full operational leasing and fleet management industry, and TomTom Telematics, global leader in professional service of vehicle tracking and tracing, which provides the company the necessary know-how and technology for the fleet management. IoGuido, on the other hand, has the support of ICS (Car-Sharing Initiative), which supplies the associated public companies the information systems and technology needed for the operation and management of operations.

Finally, it is vital for the car-sharing companies to establish partnerships with the local governments of the cities where they operate in order to align the services with the city regulations and establish agreements granting the companies operational conditions, regarding the use of the public space and parking, taxations and other benefits. These agreements are, as expected, more easily handled by public operated companies (for instance, IoGuido) and public-private companies (the case of Autolib), whose strategies and operations are aligned with the

public stakeholders. Private operated companies, on the other hand, besides depending on proper regulation for their operations, also need to negotiate with the public authorities the use of standard public parking spots (especially in the case of free-floating companies), the right to use public spaces for the construction of fixed stations (in the case of station-based operations) and other benefits (e.g., the access to limited traffic areas).

Regarding the key activities, structural similarities are identified among the analyzed companies. In all cases, the core activity is the offer of short period car rentals, and the backbone activities necessary for the business operation are the registration of users, management of reservations, billing operations, the fleet management, vehicles maintenance and the customer services. The key resources commonly comprise the vehicle fleet, the integrated information systems developed to manage the fleet and the rentals, the websites and smartphones applications, which are the main customer channels, the service and management teams. Companies operating with a station-based service model (IoGuido, Autolib, Bee and occasionally Car2Go) also have their proprietary parking spots, including recharging facilities in case of operation with electric vehicles, as important resources. The cost structure of car-sharing companies is directly related to the key activities and resources that are necessary for their operations. It is characterized by a high portion of fixed costs, related to the fleet acquisition and the development of complex information systems to operate the business. Station based operators (Autolib, Car City Club and Bee) also incur in higher infrastructure costs for the installation of the stations, although free-floating operators also install proprietary parking spots in locations with lower availability of public parking spots. Other common costs among the companies are related to maintenance, cleaning and refueling or recharging the vehicles, the management of the fleet (including vehicle repositioning), municipal taxes included in the agreements for the service authorization and the use of public facilities (as in the case of parking agreements established by free-floating operators, or the authorization for the circulation in restricted traffic areas), and personnel costs.

Thus, if we do not consider some aspects related to the different mix of the vehicles in the fleet, there is not a clear characterization of the different companies. In fact, they share common operational strategies and offer a general purpose service, without customizing it, for example, for specialized customer segments. They use the quite old-style marketing strategy of creating the market by showing their products literally on the streets. Unfortunately, even if the revenues are increasing, the profitability is still not reached. For example Car2Go, the leader of car-sharing services with about 13000 vehicles and a presence in 30 cities between Europe and North America, presents constant negative sign related to the car-sharing revenues and a loss of about 42 millions of euros in 2014 [7, 8]. This

limited usage of more complex marketing strategies is limiting the penetration of the car-sharing services. In particular, more attention should be given to the tariffs and their effects on specific customer segments rates. This is not a trivial task; in fact in order to assess the real impact of a specific tariff on a single customer type we need simulation tools able to incorporate different sources of information, including socio-demographic data, traffic simulation and user behavior simulation.

# 6 Solve: Monte Carlo based simulation

In order to perform our analysis we developed a Monte Carlo simulation. The aim of the simulator is twofold. First, to provide the managers of car-sharing companies with a tool able to quantify and certify the cost of the car-sharing service for a given user type of a specific city. Second, to use the simulation to compare the commercial behavior of different car-sharing companies and perform what-if analyses of new tariffs options. This is in line with the new trend of car-sharing companies to diversify the offer by introducing special rates according to the business model of the mobility market.

Given a certain city, a set of tariffs described in terms of price per driving minute, price per parking minute (price paid by the customer if the car is rented, but in a parking slot), price per km, the customer preferences in terms of trips, trip types, kilometers traveled per year, and a list of possible trips, our Monte Carlo simulation repeats $I$ times the following overall process:

- Identify a set of potential routes.
- Create $S$ scenarios with the random demands in term of customer trips, their temporal distribution and type.
- For each scenario $s \in S$ and until the kilometers traveled per year are not reached
  - Extract a route from the routes list, assign a departure time according to the user preferences and simulate it in terms of actual travel time and apply to it the more profitable tariff of the user type.
- Given the scenario values in terms of cost paid to travel the kilometers traveled per year, compute the expected value of the cost.
- Compute the distribution of the expected value.

In order to obtain the most reliable results of the Monte Carlo simulation, we performed a set of tuning testbeds. The values for the parameters $I$ (number of

repetitions) and $|S|$ (number of scenarios) have been set such that the standard deviation of the distribution of the expected value was less than 1% of its mean. These values were $I = 10$ and $|S| = 30$.

The cost calculation for the utilization of car-sharing services mainly depends on the usage time, the distance traveled and the number of trips (as some companies charge a fixed base price in addition to a price proportional to the distance travel). The period of utilization of the service depends on the distances traveled, on the routes taken and on the traffic conditions (which influence the average speed in which the distances are covered), while the traffic conditions depend on the routes considered in the study, and also on the period of the day. In the following subsections, we give an insight of the scenario definition process, the user profiles, the estimation of the travel times and the tariffs used in the simulation.

## 6.1 Definition of scenarios

The city of Turin is serviced by three different car-sharing companies (Enjoy, Car2Go and Car City Club), so we do not consider Autolib and Bee in our simulation. A set of different routes was defined, ranging from 2.2 to 7 km, connecting the main business districts, universities, train stations, cultural attractions and residential areas. The choice of Turin as test field of the evaluation of the economics of car-sharing was due to the presence of a broad sensor network, which measure the traffic congestion in real time. Data on traffic patterns of the city was necessary in order to calculate the duration of trips taken on different routes, on different periods of the day. In the case of Turin, real data on traffic are available at http://www.5t.torino.it/5t/ (5t is a public company responsible for the monitoring of traffic and public means of transportation in Turin) and are collected from 50 speed sensors in the city center and 100 speed sensors distributed in the suburban areas. Data are gathered in different periods of the day, during one workweek, in order to build central and suburban speed profiles (see the two circles in Figure 6, giving the distribution of the actual sensors). The data of the mean vehicle speed, expressed in kilometers per hour (km/h), are accessible at intervals of 5 minutes. We aggregated them into blocks of 30 minutes, for a total of 48 observations per day. Empirical speed profile distributions associated to the path k between two points in the urban area i and j are then generated as inverse of the Kaplan-Meier estimate of the cumulative distribution function (also known as the empirical cdf) of the speed data set aggregated into blocks of 30 minutes. More details on the definition of speed profiles and the use of traffic data in a simulation environment are reported in [20].

## 6.2 Definition of user profiles

The cost simulation considers three different user profiles: Commuters, Professional users, Casual users. The first, defined as the Commuter profile, represents individuals that might use car-sharing services to commute between their residences and work places. Hence, their trips were simulated including two different time slots: from 7 to 9am, and from 5 to 7pm, which are aligned to a regular working day. The second user profile, defined as Professional, is represented by individuals that might need a vehicle for work purposes, during a regular working day. Hence, their trips were simulated including three time slots: from 11am to 1pm, from 1pm to 3pm, and from 3pm to 5pm. Finally, the third profile was defined as the Casual user, who might use the vehicle for different purposes in periods in any time of the day. Hence, the trips were simulated including all time slots comprised in the simulation.

Another important characteristic of user profiles, which affects directly the cost calculation, is the amount of time in which users keep the shared vehicle parked during a rental. In the present simulation, the period of parking was modeled by a triangular distribution, with the mode value set in 15 minutes, lower limit set in 0 and upper limit set in 25 minutes. Longer periods of parking were considered illogical, as members most likely would opt to end the rental when parking the car and start a new rental once they need the vehicle again. For commuters, the parking probability was considered zero. For professionals, the probability of parking in each of the rentals was defined as 0.10, while for occasional users this probability was defined as 0.20.

Finally, five different ranges of distance were considered for each of the user profiles in each of the scenarios. The simulation computes the results for annual utilizations of 1000, 2000, 5000, 6000, 7000, 8000, 9000, 10000 and 15000 km.

## 6.3 Computation of trip times and overall costs for users

For each user, one route (among the defined routes) was randomly attributed to a time slot. The trip time was then calculated, based on the route distances in the central and suburban areas, and the average speeds on the center and suburb at the given time of the day (randomly attributed among the time slots of the selected user profile), as calculated on the definition of traffic patterns. The parking period for each trip was also determined, based on the probability and duration of parking, as defined in the user profiles. Finally, it was possible to calculate the user costs, according to the utilization of each car-sharing company or private vehicle included in the scenarios and by using the most profitable tariff option associated to the user.

## 6.4 Tariffs

To compute the overall costs for a user, prices and packages of each car-sharing operator must be analyzed. Car2Go offers monthly minute packages of 120 or 300 minutes at discounted rates for frequent users, and so the cost calculation was optimized for the best possible combination of minute packages per month for each customer. Car2Go and Enjoy minute rates include 50km of mileage. Given the fact that the longest route defined in the simulation had a length of 7 km, additional costs per kilometer were not incurred by users in the defined scenarios. Single routes also did not justify the utilization of hourly tariffs. Car City Club has a different pricing structure: customers must pay a minimum hourly fee (the minimum rental period is one hour, although vehicles can be delivered earlier) in addition to a variable cost per kilometer. The tariffs refer to the simplest vehicle available in the one-way service (a Fiat 500 1.2L, the same model offered by Enjoy). Finally, the data referring to private vehicle costs were obtained from a database made available at the website http://www.aci.it/ by ACI (Automobile Club Italiano), a National organization that offers a wide range of public services, including a tool for the calculation of costs of private vehicle utilization. The data refers to a Fiat 500 1.2L, the same model offered by Enjoy and Car City Club. To this costs, the additional fee of parking should be added. Different tariffs exist in any urban area. We decided to consider the cheapest one, equivalent to an annual fee of €200,00 in Turin (annual authorization for residents). Final prices were then calculated for each of the users simulated for each user profile.

Tables 1 and 2 summarize the price components of these operator and the cost of a private vehicle (as mentioned before we do not consider Autolib and Bee in our simulation because of they are not operating in the city of Turin).

| Price components | Car2Go | Enjoy | IoGuido | Private vehicle |
|---|---|---|---|---|
| Annual cost | €29 (year 1) | - | €59 | €2620 |
| Cost per min | €0.29 (base price)<br>€0.24 (120 min pack)<br>€0.23 (300 min pack) | €0.25 | - | - |
| Parking cost | see cost per minute | €0.10 | - | - |
| Cost per hour | €14.90 (not applied) | €15 (not applied) | €3.68 | - |
| Cost per km | €0.29 (> 50km) | €0.25 (> 50km) | €1.08 (> 100km) | €0.23 |

Table 1: Costs of alternatives considered in the simulation

| Fixed Costs | | Variable costs per km | |
|---|---|---|---|
| **Amortization** | €559.48 | **Amortization** | €0.066 |
| **Insurance** | €1929.00 | **Fuel** | €0.105 |
| **Taxes and fees** | €559.48 | **Tires** | €0.066 |
| | | **Maintenance** | €0.052 |
| **Total** | €2620.06 | **Total** | €0.232 |

Table 2: Estimated costs of private vehicle utilization

# 7 Test - Simulation results

Analyzing the simulation results, the most interesting solutions from an economic point of view vary according to the annual distance traveled. Figures 7, 8, 9 report the annual costs according to the user profile for the utilization of car-sharing service of the companies operating in Turin. These figures also show the annual cost for the private vehicle.

In the city of Turin the usage of Enjoy and Car2Go is more cost effective than the private vehicle for values lower than 7000 km/year. Furthermore, Car City Club is more cost effective than private car only for ranges lower than 1000 km/year, and for longer ranges the costs of Car City Club are higher than the cost related to any other solution. The reason is in the different pricing structure, that has a minimum hourly fixed fee, in addition to a fee per kilometer. Car City Club could be more cost effective for other user profiles, not included in this simulation, such as long distance travelers (the distance fee decrease for longer distances) or customers interested in longer rental time (not for a single trip).

Enjoy and Car2Go have similar results: although Enjoy base price (0,25 /minute) is lower than Car2Go (0,29 /minute), Car2Go offers discounted rates for longer range travelers. However, the price difference between Enjoy and Car2Go is marginal and the choice for the customers could be based on other factors of differentiation, such as perceived quality of the service, vehicle models, commercial partnerships, etc.

Above the range of 7000 km/year the optimal choice is the private vehicle (considering a small city-car, similar to the Enjoy's fleet vehicles). In this case the fixed costs of vehicle ownership are amortized and the marginal costs is compensated by the distance covered by the users.

For the Professional and Casual user profiles, the results vary moderately. Although Commuters have routes concentrated on the rush hours, with lower average speeds, Professional and Casual users resulted in higher final costs of utilization: this effect is explained by the costs incurred by these user profiles due to the parking time during the rental, in which, by definition, the Commuters did not incur.

Since for private vehicle utilization parking costs are modeled as fixed (as users incurred in paying annual parking permits), the costs related to private vehicles are not sensitive to the differences of the Professional and Casual users in the simulation. As a result, for Casual and Professional user profiles, a downshift in the minimum range above which the utilization of a private vehicle is more economically efficient could be observed. In these cases, using a private car became the optimal cost alternative between 6000 and 7000 km per year. Despite that, Car2Go is the best option for ranges lower than 7000 km for Commuters, Enjoy is always the best option for Casual users until the limit of 6000-7000 km. The reason for the best costs of Enjoy for these user profiles is that the company charges discounted rates for parking periods. The price differences, however, are maximized for the lowest range (1000 km), when Enjoy is 12% cheaper than Car2Go, and decrease with the increase in the traveled distance, due to the effects of discounted prices for bundles of minutes per month by Car2Go. In the case of Professional users, whose impacts motivated by parking are less significant, Enjoy and Car2Go alternate as the best option in lower ranges, depending on whether lower parking costs or lower running costs impact users the most on the bottom line.

Finally, the case of Car City Club did not vary significantly with the change of user profiles: although parking costs are already included in the minimum hourly fees, not incurring in extra parking costs is not enough to let the company to compete with the others.

# 8 Conclusions and future directions

The comparison of the operator's business models shows that all five companies share value propositions inherent to the car-sharing concept, offering a mobility alternative with low environmental impact, complementary to the available public and private transportation modes and generally economically efficient when compared to car ownership.

However, the degree in which the companies succeed in delivering these values to their customers depend on their operations characteristics. The service model adopted is the main difference between the analyzed companies: since the option for traditional round trip car-sharing (adopted by IoGuido) lessens the complexity of fleet management, this form of operation provides less flexibility for the users, who must start and end their journey in the same parking spot and pay for the service during the entire time of rental. On the other hand, the free floating model (adopted by Enjoy, Car2Go and experimentally by Bee) gives to the customers the greatest flexibility among the existing operation models. Customers can locate, optionally reserve and then access an available vehicle directly on the street and use it for any period of time, and at the end of the rental the car can be parked

in any standard parking spot on the streets inside the city area covered by the service.

Fleet size is an important asset in order to meet the customer demand and to not incur in unbalances within the covered area. Autolib, Enjoy and Car2Go rely on large scale operations with large fleets to address this question, trying to minimize fleet management efforts and letting the spontaneous use of the service by customers to reposition the largest percentage of vehicles. Another important issue is the standardization of the fleet, which facilitates vehicle acquisition (by partnerships with car producers) and provides the company a strong visual identity increasing brand recognition. Furthermore, Autolib and Bee have opted for pure electric vehicles, increasing their images related to environmental purposes; however, electric vehicle fleets increase the operational complexity, since the electric vehicles have lower range and demand considerably more time for recharging, besides the need for proprietary charging stations.

Regarding the customer channels, all the companies considered in the study reach their clients through proprietary websites and smartphone applications, and offer also a call center service for personal assistance.

Analyzing the revenue streams, all the companies charge the service usage proportionally to the rental period, and the fees already include costs related to refueling or recharging, maintenance, insurance and parking. In addition, a subscription fee is charged for new customers (with the exception of Enjoy). In order to reach different customer segments, the companies (excepted Enjoy) also offer plans with multiple subscriptions and discounted rates. The main costs for all the analyzed companies are related to the fleet acquisition (even if partnerships with car producers are in place) and management, the maintenance of the vehicles (including cleaning and refueling), local taxes for circulate and park in the city boundaries and in restricted traffic areas, and personnel costs.

Analyzing the results of the simulation for the city of Turin, the most interesting solutions from an economic point of view vary according to the annual distance traveled. In particular, the usage of Enjoy and Car2Go is more cost effective than the private vehicle for ranges lower than 7000 km/year. Furthermore, Car City Club is more cost effective than private car only for ranges lower than 1000 km/year, and for longer ranges the costs of Car City Club are higher than the cost related to any other solution.

In our opinion, the simulation environment represents a useful tool for the evaluation of cost structures of car-sharing operators. Further developments are required to use this tool in city without a network of sensors for the traffic monitoring. In fact, the traffic congestion and, consequently, the travel time have a key role on the economics of car-sharing services and an accurate forecasting is required. Future research directions will consider approximations of the traffic

congestion obtained by means of Extreme Value Theory [25, 21].

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## References

[1] Autolib (2015). Autolib web site. `https://www.autolib.eu`.

[2] Bank, W. (2013). Planning, connecting, and financing citiesnow: Priorities for city leaders. Technical report.

[3] Bee (2015). Bee web site. `http://www.bee.it/it/index.html`.

[4] Beutel, M., Samsel, C., Mensing, M., and Krempels, K.-H. (2014). Business model framework to provide heterogeneous mobility services on virtual markets. In *ICE-B 2014 - Proceedings of the 11th International Conference on e-Business, Part of ICETE 2014 - 11th International Joint Conference on e-Business and Telecommunications*, pages 145–151.

[5] Browne, M., Allen, J., Nemoto, T., D., P., and Visser, J. (2012). Reducing social and environmental impacts of urban freight transport: A review of some major cities. *Procedia - Social and Behavioral Sciences*, 39:19–33.

[6] Car2go (2015). Car2go web site. `http://www.car2go.com`.

[7] Daimler AG (2014). *Annual Report 2013*. Stuttgart, Germany.

[8] Daimler AG (2015). *Annual Report 2014*. Stuttgart, Germany.

[9] Enjoy (2015). Enjoy web site. `https://enjoy.eni.com`.

[10] Ferrero, F., Perboli, G., Vesco, A., Caiati, V., and Gobbato, L. (2015). Car-sharing services - part a: Taxonomy and annotated review. *Submitted to International Journal of Sustainable Transportation*.

[11] Firnkorn, J. and Müller, M. (2011). What will be the environmental effects of new free-floating car-sharing systems? the case of car2go in ulm. *Ecological Economics*, 70(8):1519–1528.

[12] Firnkorn, J. and Müller, M. (2015). Free-floating electric carsharing-fleets in smart cities: The dawning of a post-private car era in urban environments? *Environmental Science & Policy*, 45:30–40.

[13] Hildermeier, J. and Villareal, A. (2014). Two ways of defining sustainable mobility: Autoliband bemobility. *Journal of Environmental Policy & Planning*, 16(3):321–336.

[14] Holloway, B., Spahr, C., and Rhodes-Conway, S. (2014). Urban freight transportation: Low cost measures to reduce negative impacts. Technical report, Majors Innovation Project, `http://www.cows.org/urban-freight-transportation-low-cost-measures-to-reduce-negative-impacts` (last access 19/08/2015).

[15] IoGuido (2015). IoGuido web site. `http://carsharingtorino.it/`.

[16] Loose, W. (2010). The state of european car-sharing. project momo final report. Technical report, Bundesverband Car–Sharing.

[17] Osterwalder, A. and Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons.

[18] Perboli, G., De Marco, A., Perfetti, F., and Marone, M. (2014). A new taxonomy of smart city projects. *Transportation Research Procedia*, 3:470–478.

[19] Perboli, G. and Gentile, R. (2014). The GUEST methodology manifesto. Technical report, DAUIN - Politecnico di Torino.

[20] Perboli, G., Gobbato, L., and Maggioni, F. (2015). A progressive hedging method for the multi-path traveling salesman problem with stochastic travel times. *Journal of Management Mathematics*, forthcoming:1–21.

[21] Perboli, G., Tadei, R., and Baldi, M. M. (2012). The stochastic generalized bin packing problem. *Discrete Applied Mathematics*, 160:1291–1297.

[22] Ries, E. (2011). *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business.

[23] Shaheen, S. A. and Cohen, A. P. (2013). Carsharing and personal vehicle services: worldwide market developments and emerging trends. *International Journal of Sustainable Transportation*, 7(1):5–34.

[24] Tadei, R., Perboli, G., and Perfetti, F. (2014). The multi-path traveling salesman problem with stochastic travel cost. *EURO Journal on Transportation and Logistics*, forthcoming:doi:10.1007/s13676–014–0056–2.

[25] Tadei, R., Perboli, G., Ricciardi, N., and Baldi, M. M. (2012). The capacitated transshipment location problem with stochastic handling utilities at the facilities. *International Transactions in Operational Research*, 19:789–807.

Key Partnerships
• Europcar
• Local governments
• Company customers (refueling agreement)
• Insurance companies
• Fuel distribution companies
Key Activities
• Car rentals
• Vehicles maintenance
• Fleet management
• Customer service
• Marketing
Key Resources
• Vehicle fleet
• Service team
• Integrated system, website and application
• Designated parking spots (where applicable)
Value Proposition
• Free-floating car sharing service with a large scale fleet
• Innovative and environmental friendly transportation service
• Flexibility and mobility
• Convenience, usability and accessibility of vehicles
• Smart ForTwo (gasoline and electric powered) vehicle fleet
Customer Relationships
• Automated services through the website and application interfaces
• No permanent engagements
Channels
• Website
• Smartphone application
• Customer service call center
• On site marketing campaigns and information points
Customer Segments
• Private users
- Frequent clients
- Occasional clients
- Students
• Corporate clients
Cost Structure
• Vehicle fleet acquisition
• Maintenance
• Fueling and cleaning vehicles
• Personnel costs and customer services
• Insurance contracts
• Other expenses related to improper use of the service
• Municipality taxes
Revenues
• Fixed subscription fees (only upon registration of new users)
• Rental fees (per minute, hour or daily rate)
• Extra fees per kilometre (above the included mileage per trip)

Figure 1: Business model canvas of Car2go

Figure 2: Business model canvas of Enjoy

Key Partnerships
Municipality
Car Sharing Initiative (ICS) and Italian Ministry of Environment
Car manufacturers (FCA), fuel distributors, insurance companies
Retail companies, universities and other promotion partners
Key Activities
Car rentals
Vehicles maintenance
Fleet management
Customer service
Key Resources
Vehicle fleet
Service team
Integrated system, website and application
Exclusive parking areas
Value Proposition
Mobility alternative, integrated with other public transportation modes
Economical, accessible and environmental friendly service
Traditional and one-way car rentals
Varied fleet of vehicles, for different customer needs
Customer Relationships
Self-service automated services through the website and application interfaces
Optional call-center service
Channels
Website
Smartphone application
Customer service call center
Customer Segments
Private users
Corporate clients
Public entities
Cost Structure
Vehicle fleet acquisition
Maintenance
Fueling and cleaning vehicles
Personnel costs and customer services
Insurance contracts
Other expenses related to improper use of the service
The company is partially financed by the Italian Ministry of the Environment
Revenues
Annual subscription fees (or optionally an activation fee per use)
Fixed rental fees (hourly or daily, according to the period of the day and type of vehicle chosen)
Fees per traveled kilometre

Figure 3: Business model canvas of car City Club (loGuido)

| **Key Partnerships** | **Key Activities** | **Value Proposition** | **Customer Relationships** | **Customer Segments** |
|---|---|---|---|---|
| • City of Paris<br>• Other 40 french municipalities surrounding Paris<br>• Bolloré Group<br>• Bluecar<br>• Pininfarina<br>• CECOMP<br>• batScap | • Car rentals<br>• Vehicles maintenance<br>• Fleet management<br>• Customer service<br>**Key Resources**<br>• Bluecar vehicle fleet<br>• Autolib stations, kiosks and reception center<br>• Integrated information system, website and application<br>• Management and service team | • First large scale public electric car sharing service company<br>• One way point-to-point rentals<br>• Efficient and low environmental impact mobility alternative, complementary to public transportation services<br>• Flexibility, availability and economic efficiency when compared to car ownership | • Automated services through the website and application interfaces<br>• Customer service call center<br>**Channels**<br>• Reception center and Autolib's kiosks<br>• Website<br>• Smartphone application<br>• Customer service call-center | • Private users<br>- Frequent users<br>- Occasional users<br>- Tourists<br>- Young drivers<br>- Households<br>• Corporate clients<br>- Small<br>- Medium<br>- Large<br>• Owners of electric vehicles (charging services) |
| **Cost Structure** | | **Revenues** | | |
| • Vehicle fleet acquisition<br>• Instalation of Autolib stations, kiosks and reception center<br>• Maintenance, cleaning and recharging<br>• Development and maintenance of website, app and information system<br>• Personnel costs and customer services<br>• Insurance contracts<br>• Other expenses related to improper use of the service | | • Private user plans<br>- Subscription fees<br>- Rental fees (per minute)<br>• Corporate clients<br>- Service packages<br>Additional fees per minute and per extra driver subscription<br>• Charging service plans for electric vehicle owners<br>- Subscription fees<br>- Usage fees | | |

Figure 4: Business model canvas of Autolib

Key Partnerships
• Siemens
• Renault (electric vehicle supplier)
• TomTom Telematics
• ALD automotive
• Local partners (installation of Bee-Points)
• Insurance companies
Key Activities
• Car rentals
• Vehicles maintenance
• Fleet management
• Customer service
• Gathering customer feedback
Key Resources
• Electric vehicles fleet
• Bee-Points (private parking spots with recharging plugs)
• Service team
• Integrated system, website and application
Value Proposition
• First exclusively electric car sharing service company in Italy.
• Free float service for rental of exclusively electric cars (Renault Twizy models)
• Efficient and low environmental impact mobility alternative
• Flexibility, availability and economic efficiency when compared to car ownership or other car rental services
• Competitive pricing
Customer Relationships
• Automated services through the website and application interfaces
Channels
• Website
• Smartphone application
• Customer service call-center
Customer Segments
• Private users
- Locals
- Tourists
• Corporate clients
Cost Structure
• Vehicle fleet acquisition
• Installation of Bee-Points
• Maintenance, cleaning and recharging
• Development and maintenance of website, app and information system
• Personnel costs and customer services
• Insurance contracts
• Other expenses related to improper use of the service
• Municipality taxes
Revenues
• Annual subscription fees
• Rental fees (per minute or daily, no mileage limit)

Figure 5: Business model canvas of Bee

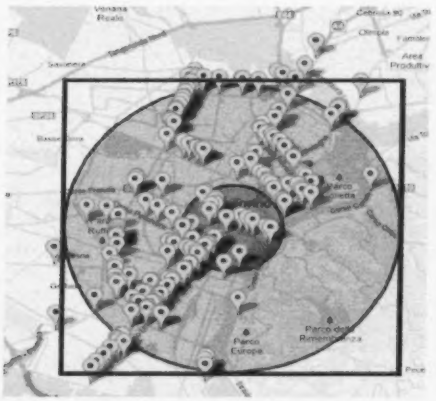

Figure 6: Distribution of central (dark gray circle) and suburban (light gray circle) speed sensors in the city of Turin in Italy. Figure taken from [24].

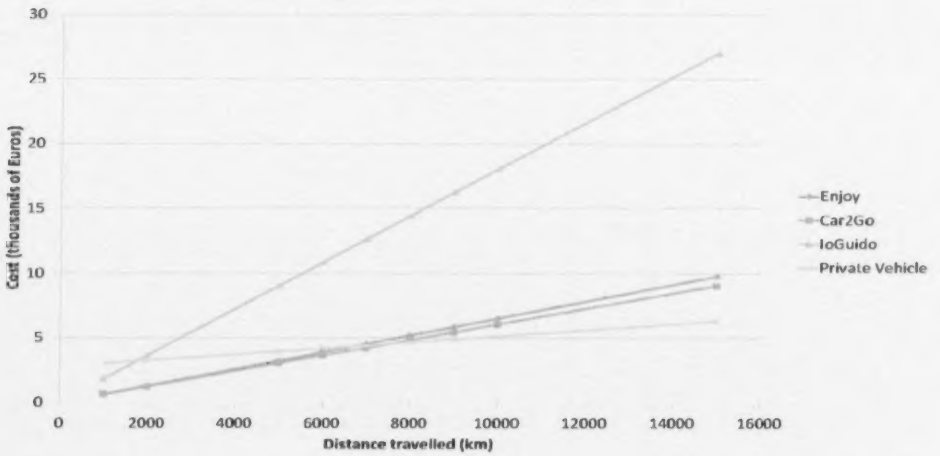


Figure 7: Annual costs for the Commuter user profile in Turin.

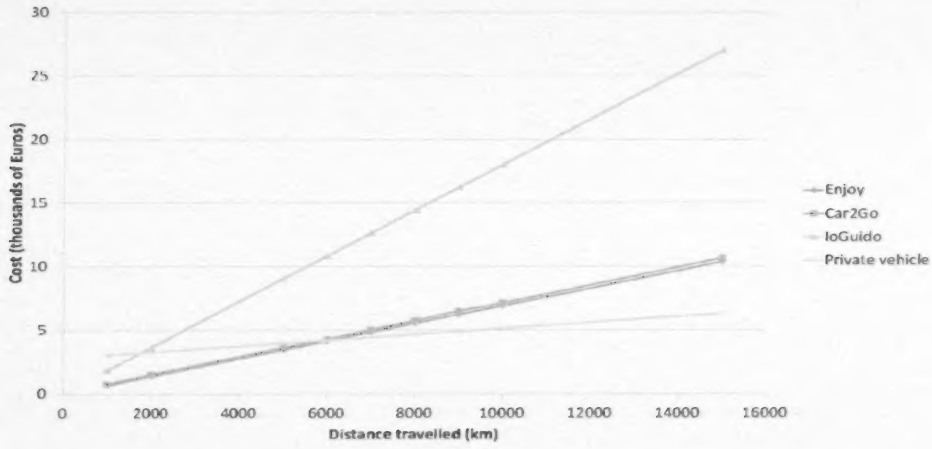


Figure 8: Annual costs for the Casual user profile in Turin.

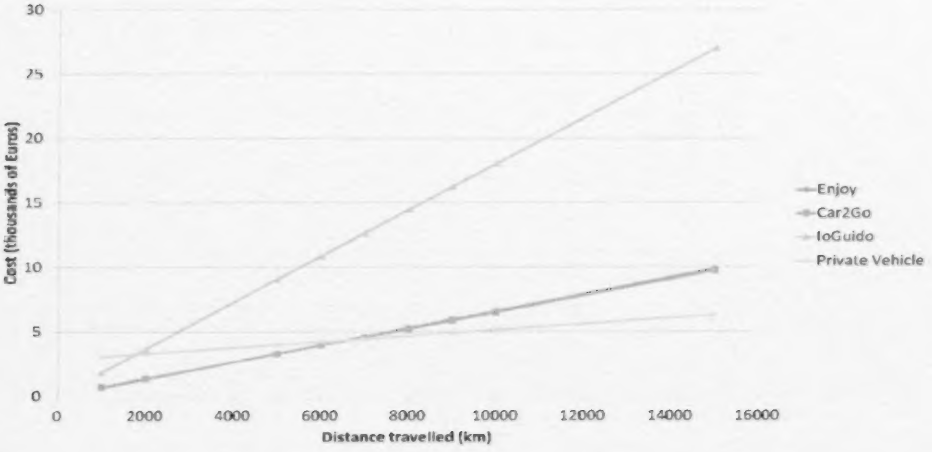


Figure 9: Annual costs for the Professional user profile in Turin.